

# Starvation And Epigenetics: DNA Can Hold Onto The Memory Of Starvation For Three Generations, And Now Researchers Know How

By Dana Dovey | Aug 7, 2014 02:14 PM EDT

Pregnant women who experience famine are able to pass on the living memory in their genes. Photo courtesy of Teza Harinaivo Ramiandrisoa CC BY-SA 2.0

The fascinating field of epigenetics studies how different environmental influences actually have the power to change gene expressions in our DNA. Recently, a team of researchers discovered that mothers who experienced a physical hardship such as famine undergo a change in their DNA, which they pass on for up to three generations.

In their study, recently published in the online journal *Cell*, a team of researchers from Israel and America explored the genetic mechanism that allowed the body's response to starvation to be passed on through several generations. In their exploration, the team identified a mechanism called "small RNA inheritance" to be responsible for passing on the memory of starvation, according to a recent press release. "To the best of our knowledge, our paper provides the first concrete evidence that it's enough to simply experience a particular environment — in this case, an environment without food — for small RNA inheritance and RNA interference to ensue," explained Dr. Oded Rechavi, one of the researchers involved in the study.

In the experiment, researchers starved pregnant worms and then observed how this starvation affected their offspring through various generations. For obvious reasons, it would be unethical for this experiment to be tested on anything other than worms. Unfortunately, the hardships of war first gave researchers the idea the body's reaction to starvation could be genetic.

In 1944, the Nazis blocked food supplies from entering the western Netherlands, and a period of widespread famine quickly followed. Researchers observed the effect that starvation of pregnant women had on their children, but at that time had no idea what caused this to happen. Today, with the help of expanded knowledge and more advanced technology, the researchers were able to solve the mystery of inheriting life experiences. "We identified genes that are essential for production and for the inheritance of starvation-responsive small RNAs," Rechavi said.

Our DNA's "memory" is essentially its ability to pass on response templates for the needs of specific cells. The small RNAs are a species of regulatory RNA-molecules that regulate gene express. In the starved worms, starvation-responsive small RNAs were produced. These molecules were found to be involved in nutrition and incredibly were passed on through at least three generation of worms. "We were also surprised to find that the great-grandchildren of the starved worms had an extended life span," Rechavi said.

The researchers speculate the mechanism functions as a way for parents to "prepare their progeny for hardships similar to the ones that they experience." This would give them a better chance at survival and more importantly a better chance at passing on DNA.

Starvation is not the only environmental response that has been observed to be passed on in animal testing. A study found that the effects of marijuana were also able to span three generations, with the pups of mice exposed to the drug displaying less motivation to seek the reward of “highly tasty food.”

Source: Rechavi O, Houri-Ze'evi L, Anava S, et al. Starvation-Induced Transgenerational Inheritance of Small RNAs in *C. elegans*. *Cell*. 2014.